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WHAT MATHEMATICAL SUBJECTS SHOULD BE INCLUDED IN THE CURRICULUM OF THE COLLEGE?

BY C. C. GUTHRIE.

I was requested to prepare a paper dealing with the question of college preparation in mathematics for pre-medical students. After due consideration, I have decided to occupy the time allotted in sketching some of the conditions encountered by the medical student, and some of the ideals being followed in the leading medical schools, and leave the question of the kind and extent of mathematics to be offered to such students in the college, to the judgment of the college faculty, rather than to take the matter up more dogmatically. For thus it will receive consideration by the men who are best qualified to specify the amount and kind of mathematics to be offered,—not to mention the fact of its being their right and duty. If in presenting the matter, I may seem to get far afield from mathematics, it will be intentional, for only by considering the medical student's needs, and the conditions as a whole, can we meet such special needs most efficiently.

It is generally recognized by students of this subject of pre-medical training, that in addition to the more general college courses, such as English, history, mathematics, etc., the work should comprise at least one year each of physics, chemistry and biology. Also that the student should acquire a reading knowledge of French or German, or preferably both. My own views in the matter are represented in the outline of the combined six-year medical and college course as set forth in page 77 of the general catalogue of the University of Pittsburgh for 1911–1912. This being the case, I believe that the time placed at my disposal can be more profitably occupied by considering in a more general way the conditions to be met and some possible ways of meeting them.

The aim of all such considerations is to make a doctor who is not only equipped to follow the best practices known to medicine in the treatment of the sick, and to look after the welfare of the community as a whole from his knowledge of public hygiene and preventive medicine, but in addition, one who possesses that which we speak of as the result of the so-called cultural training, in order that he may be a good citizen, an integral mainstay of society and a credit to his profession and to his alma mater. It is of course unnecessary to present arguments in justification of these purposes, but I wish to say in respect to the last consideration, namely, in our oft-expressed purpose to train our students so that they may be a credit to our institutions, that we may by the public be considered selfish. But such a conclusion is untenable when it is pointed out that the advancement of our educational institutions is, in the sum total, of far greater benefit to the present and future generations of the community and public at large than to the teaching staffs of such institutions. It is not difficult to convince anyone of the soundness of the obvious arguments which support this assertion.

In order to save time in discussing the relationships that should exist between the high school and preparatory school training and college training in the case of pre-medical students, it will save time if we first briefly consider the nature and scope of the training demanded of such students in the medical school itself.

From the nature of modern medicine, an extensive training in a comparatively large number of subjects is demanded of the student. Only a short time ago it was considered that all subjects of an essential nature could be taught adequately to a student in the short space of two years. Now the time required by all medical schools of standing is four, and in some instances five years. And there is reason for believing that soon a minimum of five years will be the legal requirement of some states. The increase in time required for the medical courses is due to the extension of knowledge in the older branches, and the addition of new ones. And since knowledge in each branch is constantly being augmented, it becomes increasingly more difficult to devote adequate time to each subject in the allotted four years. Thus far, additions to knowledge of any particular subject have, in general, resulted in a demand for additional time in that subject for the student. It is my belief that we are rapidly approaching the time when all courses will be closely scrutinized with the view of eliminating certain vitally nonessential portions. Indeed this step has already been taken in certain instances. For example, the time allotted to anatomy has been reduced in a number of progressive schools. As the viewpoint of medical teachers broadens out, it will result in a closer correlation of the various subjects and thus automatically any parts of subjects, such as anatomy or physiology, that do not bear an important fundamental, or practical relation to medicine or surgery as a whole will be eliminated as a part of the regular medical course. Thus a certain gain in time may be effected. In the past the greatest time-saving factor has been the putting earlier of such courses as could be given adequately in the college,—such examples are physics, chemistry and biology. To meet this new condition it has been necessary for those schools adopting the plan to require one or more years of college work including courses in such subjects before entering the medical school proper. But even with this arrangement in force the schedule of the medical student is very full. Indeed it is doubtful if the schedule of any school, where the requirement is in force, measures up to the highest pedagogical standards.

Turning now to the question of pre-medical training, we may consider the college.

As above indicated, for those schools in which biology, physics and chemistry are required for entrance, the college must teach the subjects adequately from the medical standpoint. But as it is in the college the student receives what may be termed his academic cultural training, it is undesirable to occupy too much of his time with these basic scientific subjects. To be brief, the work in biology should comprise general botany and zoology. Since, in his medical work, he will devote much time to animal dissection and histology, it is desirable that the major emphasis be laid upon the work in botany. The minimum time for a satisfactory course in biology would be one year.

The course in physics should be of a general nature and include mechanics, heat, electricity and light with especial emphasis on refraction, and sound. The laboratory work should be exacting, and of as practical nature as possible in order that the course may be completed in one year. Chemistry should consist of general inorganic, organic, and qualitative and quantitative analysis. The time required is two years. The course should be very exacting and like physics be made as practical as possible. In arranging such courses it should be borne in mind by the instructors that the purpose is not to make of the student a biologist or a physicist or a chemist, but that the aim is to give him a sound, adequate and practical training in preparation for his medical studies. If later he desires to specialize in any of these fields, he has the necessary foundational training upon which to build.

Closely related to physics and chemistry is another science that we are now requiring of our combined six-year students, namely physical chemistry. Time does not permit a discussion of the important relation of physical chemistry to medical science, but I may say that many views held in medicine can not be properly understood without a knowledge of the fundamental principles of physical chemistry. And advances in medicine from the standpoint of physical chemistry are constantly being made. The minimum requirement in this subject should be at least one quarter, and in the course considerable time should be devoted to laboratory work.

French and German should be taught at least to the extent of giving the student a practical knowledge of their fundamentals in order that he may read scientific matter printed in these languages, for many important medical works are issued in them. It is true that a number of publications printed in English abstract most of the important articles appearing in French and German, but such abstracts as a rule only give a superficial knowledge of the original papers themselves. In addition, in many communities, it is very desirable that the practising physician be able to speak one or more of the foreign languages.

The importance of training in psychology for the medical student is becoming more and more recognized as its application is leading to improvement in the treatment of certain types of nervous cases. In the college, therefore, he should receive the course comprising the foundational essentials for building up a knowledge in this subject when he comes to the work in psychiatry. Also a short general course in sociology is of great advantage to a student preparing for medicine. Time does not permit specific mention or discussion of the other courses that the pre-medical student should take in the college.

As in the college, the work of the high school student preparing to enter medicine through the college can be specifically arranged to very great advantage. But I shall only say that it is probably disadvantageous for such a student to take up biology or exact sciences other than mathematics in the high school. For the advantage of such courses to the student who later takes them in the college is at most but slight; and, indeed, he may labor under disadvantage in the college if in the high school he obtained only a smattering or at best a superficial knowledge in the subjects. Also in taking up such subjects in the high school he will expend much time that could, to great advantage, be devoted to such subjects as English, mathematics, geography, history, Latin, etc. In regard to mathematics, whether it is taught in the high school or college, it should be taught as largely as possible as a laboratory subject in order that the student may acquire a concrete and practical knowledge so that when he comes to apply it, as he must do in physics, chemistry and physical chemistry, he may be efficiently equipped. The regular medical student will have no need of mathematical training other than that which is necessary for the work required of him in physics, chemistry and physical chemistry. So in order to plan an ideal course in mathematics for such students, it is necessary to consult the physicist, the chemist and the physical chemist rather than members of the medical faculty.

Of course, students preparing to specialize in certain of the various medical fields, as in the physiology of the special senses, or in the corresponding clinical branches, particularly those dealing with the eye or ear, have need of more extensive preparatory training, especially along the special lines that they propose following. But as the number of such special students is relatively very small, and since such specialization is usually undertaken subsequent to the completion of the regular medical course, and in view of the present overloaded curriculum that the regular student must follow, it seems unwise to require such additional special preparatory courses of the regular student. However, as it is desirable that the pre-medical student be offered the maximum amount of work in cultural subjects, *i. e.*, subjects of general training and broadening value aside from the courses of necessity fixed in his college curriculum (viz., physics, chemistry, etc., as described above), it may be desirable to include mathematics among such courses—the question being one of the relative value of mathematics in this respect as compared to other available courses offered in the college. The question, therefore, is one for consideration by the college in consultation with a committee from the medical faculty.

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